

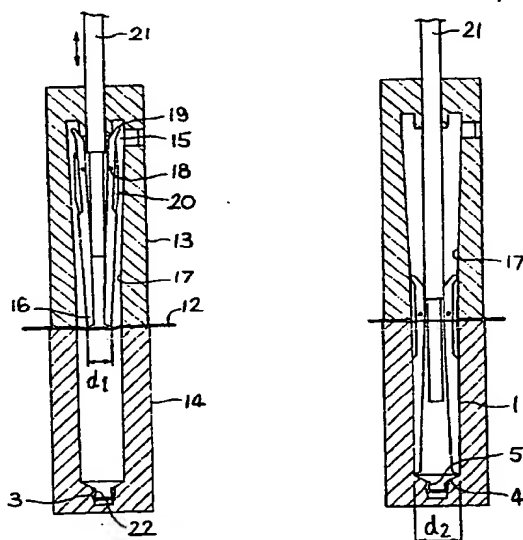
PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : B29C 51/08 // B29L 23:20	A1	(11) International Publication Number: WO 95/01255 (43) International Publication Date: 12 January 1995 (12.01.95)
<p>(21) International Application Number: PCT/AU94/00371</p> <p>(22) International Filing Date: 4 July 1994 (04.07.94)</p> <p>(30) Priority Data: PL 9736 2 July 1993 (02.07.93) AU</p> <p>(71) Applicant (for all designated States except US): TETRA LAVAL HOLDINGS &amp; FINANCE S.A. [CH/AU]; 3 Foray Street, Fairfield, NSW 2165 (AU).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): FLECKNOE-BROWN, Tony [AU/DE]; Ludwigstrasse 8, D-Jugenheim (DE). BRUHN, Krister [SE/DE]; Seeheimer Strasse 24 A, D-Seeheim-Jugenheim (DE).</p> <p>(74) Agent: PHILLIPS ORMONDE &amp; FITZPATRICK; 367 Collins Street, Melbourne, VIC 3000 (AU).</p>	<p>(81) Designated States: AU, JP, US.</p> <p>Published With international search report.</p>	

(54) Title: COLLAPSIBLE PACKAGE



## (57) Abstract

Apparatus and method of forming a container. The method includes heat softening a sheet of thermoplastic material, holding the sheet, moving a stretching tool relative to the sheet so as to cause the tool to press against the sheet and to stretch the sheet and moving a plurality of fingers provided on the stretching tool. The fingers moving outwardly from the axis of the tool to dilate the sheet as the tool moves relative to the sheet to form a hollow container with a base. Providing a cavity of smaller cross section than the container and causing a portion of the base of the container to conform to the surface profile of the cavity whereby an integral neck is formed on the hollow container. Apparatus is also provided to carry out the method according to the invention.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

- 1 -

COLLAPSIBLE PACKAGE

This invention relates to collapsible plastic tubes suitable for packaging pastes or liquids and relates particularly to such tubes incorporating an integral  
5 moulded or threaded neck.

Collapsible tubes, for the packaging and dispensing of pastes such as toothpaste and liquids, such as shampoos, traditionally have been made by impact extrusion of zinc alloys, in a single piece body.

10 More recently, these have been fabricated from multi-layer plastics, which involved extrusion or seam-welding of a tube and assembly of this to a moulding incorporating a threaded neck, capable of being fitted with a screw closure.

15 These procedures, because they require no assembly step to incorporate a moulded or threaded neck, result in a product whose cost must reflect this step.

Whilst conventional blow moulding procedures can produce tubular packages with an integral moulded or  
20 threaded neck in the one blow moulding step, the physical limitations of conventional blow moulding processes in relation to matters such as wall thickness control and difficulty in blow moulding multi-layer materials mean that conventional blow moulding processes are generally  
25 not suitable where multilayer plastics or close wall thickness control are required.

It is therefore an object of this invention to provide a method for producing containers incorporating a moulded or threaded neck, which obviates or ameliorates  
30 the foregoing disadvantages.

In US Patent 4,288,401 there is described a process for forming containers from heated thermoplastic sheet material involving stretching the material with an array of fingers or blades arranged on a plunger, the fingers or  
35 blades expanding as the plunger moves into the plane of sheet material. This process known as cuspatation-dilation allows accurate control of the parameters relating to the formation of the containers from the sheet. All disclosures in US patent 4,288,401 are herein incorporated  
40 by reference.

- 2 -

Applicants have now been able to modify a cuspatation-dilation process to produce a container with an integral moulded neck.

5 In one aspect the invention provides a method of forming a container including the steps of:

- i) heat softening a sheet of thermoplastic material;
- ii) holding the sheet;
- 10 iii) moving a stretching tool relative to the sheet so as to cause the tool to press against the sheet and to stretch the sheet;
- 15 iv) moving a plurality of fingers provided on the stretching tool said fingers moving outwardly from the axis of the tool to dilate the sheet as the tool moves relative to the sheet to form a hollow container with a base;
- 20 v) providing a cavity of smaller cross section than the container; and
- vi) causing a portion of the base of the container to  
25 conform to the surface profile of the cavity whereby an integral neck is formed on the hollow container.

30 In a preferred aspect of the invention, the cavity may comprise a closure such as a screw threaded closure. Thus as a result of the step providing for conformation of the container base portion, the neck will be formed with a screw thread complementary to the closure.

35 Alternatively the cavity may comprise a mould cavity which is shaped to provide any of a number of features in the form of an integral neck. For example, the integral neck may take the form of a shaped nozzle such as a spray nozzle, a tube, a flared section which may act as a funnel or pedestal, or simply an attachment feature shaped to facilitate the attachment of another functional member to  
40 the neck and hence the container.

- 3 -

In one embodiment the closure may itself be formed of more than one component. The first of these closure components may form the cavity wall and may simply serve as a means of attachment of the composite closure to the container neck. In such a case the first closure component may be formed of a material which readily heat bonds to the heated thermoplastic material of the neck as it is being formed within the closure. In another aspect the profile of the surface of the first component may be such as to mechanically lock the neck of the container in place.

The conformation step may be achieved by blow moulding the base using the cavity or closure as the mould.

Alternatively, the stretching tool may incorporate a push rod to press a portion of the base of the container into the cavity. The dimensions of the push rod relative to the cavity and the degree of travel of the push rod into the cavity can be used to control the thickness of the wall of the neck and also to provide a sealing portion sealing off the mouth of the neck, the sealing portion having a desired or controlled thickness or profile.

Where a relatively thick neck is required, the conformation step may be carried out before or during the dilation of the sheet. This may be achieved by having the cavity move in concert with movement of the stretching tool.

As the process of the invention is suitable for formation of containers under aseptic conditions, the containers with integral necks may be constructed to be suitable for a range of medical applications such as colostomy bags, blood sachets etc.

In a further aspect the invention provides apparatus for stretch-forming a heat softened sheet of thermoplastic material, the apparatus comprising means to hold the sheet against substantial non-stretching movement, a stretching tool, and means to cause a primary movement of the stretching tool relative to the sheet so as to cause the tool to press against the sheet and to stretch the sheet the stretching tool comprising at least one tip for pressing against the sheet to cause it to stretch, means

- 4 -

to dilate the sheet simultaneously with the continued primary movement of the stretching tool in a direction transverse to the direction of the primary movement of the tool, cavity means of reduced cross section with respect to the container formed by said dilation, and means to conform a portion of the sheet to the surface profile of the cavity.

The conforming means may comprise a plunger adapted to push a portion of the sheet into the cavity.

Alternatively the conforming means may comprise an arrangement for blow moulding a portion of the sheet to conform to the surface profile of the cavity.

The apparatus may include means for moving the cavity in concert with the stretching tool.

In order to assist in arriving at an understanding of the present invention, a preferred embodiment is illustrated in the attached drawings. However, it should be understood that the following description is illustrative only and should not be taken in any way as a restriction on the generality of the invention as described above.

Figure 1 shows a cross-sectional view of a single piece collapsible tube.

Figure 2 is a cross-sectional view at A of Figure 1.

Figure 3 is a cross-sectional view at A of Figure 1, but showing a two piece cap.

Figure 4 is a cross-sectional view of a single forming unit.

Figure 5 is a cross-sectional view of a single piece collapsible tube.

Figure 6 is a cross-sectional view at A of Figure 1.

Figure 7 is a cross-sectional view of a single forming unit.

Figure 8 is a cross-sectional view of the upper and lower parts of a unit forming tool.

Figure 9 is a cross-sectional view of the upper and lower parts of a unit forming tool in the initial clamp position.

Figure 10 is a cross-sectional view of a unit forming tool in the final formed position.

- 5 -

Figure 11 shows the product of Figure 1 with different threaded ends.

Figure 12 is a cross-sectional view of the section B shown in Figure 11.

5        Figure 13 is a cross-sectional view of the section A shown in Figure 11.

Figure 14 is a cross-sectional view in the final formed position of the unit forming tool.

10       Figures 1 and 3 show two versions of such a single-piece collapsible tube, one with an open end, for closure with a transverse heat-seal in the traditional way. The other with an optional rigid end flange together with a separate foil closure, which will be capable of standing on its base.

15       Figures 1 to 3 show a collapsible tube comprising a thin cylindrical, tapered conical or non-cylindrical wall (1) which is longitudinally reinforced by evenly spaced thicker ribs (2), together with an integral, relatively thicker frustro-conical base-end (4) and an integral  
20       threaded nipple with formed-in thread (5) which has a wall thickness similar to the base-end (4) and the nipple closure membrane (6). A separate end cap, (3) is supplied with this empty open ended tube which is then to be filled through the open end (11). After filling this open end is  
25       flattened and heat sealed transversely. All of these features (excepting the end cap 3.), are incorporated into a single piece forming, which is to be thermoformed from a relatively thick sheet of molten thermoplastic material, by the method and apparatus of Figure 4.

30       An alternative to the single piece cap is a two piece cap assembly shown in Figure 3 which can also be included as an integral part of the collapsible package of the invention. In this case, the closure comprises an inner threaded ring 7 which is pre-assembled to an outer  
35       cap 8. The material making up the base-end 4 whilst it is at a formable temperatur , is then formed by the action of pressure into this two piece cap (7, 8) and is retained within the lid assembly and held from turning within or pulling out from the threaded ring (7), by the undercuts 9  
40       shown in the inside and at the base open end of the

- 6 -

threaded ring 7. The methods of applying this two piece cap (7, 8) to the product are the same as for applying the single piece cap 3 and are detailed further in this specification.

5 Figure 4 shows the single forming unit of a multiple unit set of tooling, of typically 40 such units, used to form the product of the invention. In view A of Figure 4, a sheet of relatively thick, heat softened thermoplastic material (12) is clamped between a barrel cam (13) and a  
10 cavity mould (14). A plastic screw cap, (3) has already been placed into the mould, before clamp. At clamp, the sheet (12) is brought into contact with a set of forming blades (16), which are arranged (in the case of a product with cylindrical or frustro-conical shape) with their tips  
15 in circle of initial diameter  $d_1$ .

View B. of Figure 4, shows the final position of the tooling after the product has been finish formed. Here, the shaft (21), to which the cluster of blades (16) is attached by means of a pivot ring (18) and a slotted boss  
20 (20), is moved to its downmost position, where the tips of the blades assume a final diameter of  $d_2$ . After the movement of the blades is completed, pressurized air is introduced through the port (15) to make the bottom of the sheet conform to the interior surface 22 of the cavity  
25 constituted by the screw thread end cap 3.

The final thickness of the base-end (4) and of the nipple (5) thus depends on the ratio of  $d_2$  to  $d_1$  and on the initial thickness of the sheet (12).

The thread section of the nipple (5) is formed  
30 directly by the thread on the cap (3) which is to be moulded from a material which does not heat bond to the material of the product and which is not softened or distorted by contact with this hot material. Many possible combinations of materials for the product and the  
35 cap (3) will be known to those skilled in the art, for example, the product could be made from a mono or multilayer sheet of polypropylene and the cap from a higher melting point polyamide.

Figure 5 shows a possible variation of the product,  
40 which optionally has a rigid base flange, (23) capable of

- 7 -

being closed with a heat-sealed foil or film, (24). This product will be capable of standing up on its end when filled, during use.

5 A further variation to the threaded nipple 5 is also shown in Figures 5 and 6. The nipple area can be formed by compression moulding between the cap (3) and the rod (25) of Figure 7. This will enable a greater thickness of the nipple wall in comparison to the wall of the base-end (4) and will result in an internally moulded surface  
10 (26). A further advantage will be the ability to reduce the thickness of the nipple closure membrane (6) in relation to the nipple wall and the base-end.

The method by which this is achieved is shown in Figure 7, wherein a rod (25) protrudes beyond the tips of  
15 the blades (16). On initial clamp a portion of the thick, unstretched heat-softened sheet (12) is wrapped onto the relatively cooler rod end (25). As the tooling is pushed to its final position by the movement of the tool push rod shaft (21), this slug of thick material is carried by the  
20 rod end down into the threaded cap (3) and is moulded into the cap by compression between the cap and the rod end.

The force with which the rod end 25 is pushed into the end cap 3 will determine the thickness of the nipple end (6). The mechanical clearance between the outer  
25 diameter of the rod (25) and the inner diameter of the end cap (3) will determine the wall thickness of the nipple and the wall thickness of the base-end 4 will be primarily determined by the ratio of  $d_1$  to  $d_2$  and by the starting thickness of the sheet (12).

30 As can be seen in Figure 7, the starting penetration of the blade tips (27) into the cavity will be greater than for the tooling of Figure 4 in order to ensure that the blade action does the work of controlling the wall thickness distribution of the product according to the  
35 method of "cuspatation dilation" forming as detailed in US Patent 4,288,401, which is herein incorporated by reference .

Figure 8 shows the upper and lower parts of a unit forming tool, in the open position. Typically a full  
40 production tool comprises many of these units operating in

- 8 -

close spacing and fitted into a common pair of opposed holding blocks. The tool is used to form a single piece collapsible tube into a screw cap which is first to be introduced into the mould. A typical screw cap (30) is to be inserted into a receiver (31) machined into a cylindrical or non-cylindrical mould (32). The mould 32 is itself mounted on the end of a retractable shaft (33). A Cuspation/Dilation forming tool (34) as described in US Patent 4,288,401 is fitted with an extended metallic or non-metallic forming rod (35), which protrudes from the open end of the barrel cam (36).

Figure 9 shows the opposed pairs of the tool in the closed position with a sheet of relatively thick, heat softened thermoplastic material, (37) clamped between the barrel cam (36) and the cavity mould (32). At clamp, the sheet (37) is brought into contact with blades of the forming tool (34), which are arranged (in the case of a product with cylindrical or frustro-conical shape) with their tips in circle of initial diameter  $d_1$ . On or soon after the initial clamp of the sheet (37) the inner part of the sheet is forced by the rod (35) into the open end of the cap (30), there to be moulded into the thread. The material (38) forced into thread will be at or near to the thickness of the starting sheet. The material (39) at the end of the rod (35) will be of another, much lesser thickness and the annulus of material (40) will be unstretched at this time, but will later become part of the cone end of the collapsible tube.

Figure 10, shows the final position of the tooling after the product has been finish formed. Here, the forming tool (34) has been moved to its downmost position, where the tips of the blades assume a final diameter of  $d_2$ . After the movement of the blades is completed, pressurized air is introduced through the port (41).

The final thickness of the cone-end (42) thus depends on the ratio of  $d_2$  to  $d_1$  and on the diameter of the rod (35), as well as on the initial thickness of the sheet (37).

The advantages of this product and method manufacture are:

- 9 -

- 5       -     The cap can be easily placed at high speed, into a locating hole protruding from or flush with the top end of a deep cavity mould. This removes the need for a deep reach into the cavity mould.
- 10       -     The material formed into the thread area can be very substantially thicker than the rest of the final forming ensuring security of the screw closure.
- 15       -     The material forming the end seal membrane at the cap end, can be of any desired thickness as it is squeezed out whilst the material is fully molten and in its least viscous state.
- 20       -     The material thickness of the cone end can be controlled independently of the thickness in any other part of the final tube.
- 25       -     The material thickness of the walls of the tube can also be controlled independently of that in any other part of the finished tube.

25       Therefore the tube made with the method described above can be engineered to suit each individual application with minimal use of plastic material and manufactured in a single operation, from molten sheet, at high speed in a very productive, multi cavity forming tool.

30       Figure 11. This shows the product of Fig. 1 with two different threaded ends, shown in Figures 12 and 13, one forming a nozzle with a very thin membrane remaining at its apex which can be easily punctured with a needle to provide for atomised spraying, or cut off further down the shank for the application of pastes. The end in Figure 13

35       is formed by moulding the material in compression between a thread mould form or a pre-inserted lid and an optionally non-metallic push rod extension of the stretching tooling.

40       The threaded end in Figure 12 is formed in compression between the mould and a shaped push rod

- 10 -

extension, which has a conical form to mould the inside surface. By pushing this inside form very close to the mould surface at the very tip of the nozzle, the thickness of material there can be reduced to an extremely thin  
5 membrane or possibly perforated entirely.

The drawing also shows an optional flanged end on which a membrane seal may be applied after filing.

Figure 14 shows the means by which a thread form may be formed onto the end of the tube of our invention. In  
10 this case the thread form is part of the movable rotatable mould end closure 43. When finally formed, the product can be removed from the mould end closure by rotating it with the shaft, 33 to unwind on the thread. The unwinding  
step may preferably be carried out whilst the rod-end 25  
15 remains inserted in the end cap of the product, which has shrunk onto the rod-end so that the product is not damaged by twisting during the unwinding step.

Various alterations, modifications and/or additions may be introduced in the constructions and arrangements of  
20 parts previously described without departing from the spirit or ambit of the invention as defined by the appended claims.

25

30

35

40

- 11 -

CLAIMS

1. A method of forming a container including the steps of:
- 5
- i) heat softening a sheet of thermoplastic material;
- ii) holding said sheet;
- 10 iii) moving a stretching tool relative to said sheet so as to cause said tool to press against said sheet and to stretch said sheet;
- 15 iv) moving a plurality of fingers provided on said stretching tool said fingers moving outwardly from the axis of said tool to dilate said sheet as said tool moves relative to said sheet to form a hollow container with a base;
- 20 v) providing a cavity of smaller cross section than said container; and
- vi) causing a portion of said base of said container to conform to at least a portion of the surface profile of said cavity whereby an integral neck is formed on
- 25 said hollow container.
2. A method according to claim 1 wherein the cavity is a closure, such as a screw threaded closure, and said
- 30 integral neck is formed complimentary to the cavity surface profile of said closure.
3. A method according to claim 1 or 2, in which said closure is a composite closure formed of a plurality of
- 35 components and wherein one of said plurality of components forms said surface profile of said cavity.
4. A method according to claim 3, wherein said one of said plurality of components serves as a means of
- 40 attachment of the others of said plurality of components

- 12 -

to said integral neck.

5. A method according to claim 3 or 4 wherein said one of said plurality of components includes means to be  
5 mechanically locked to said integral neck.

6. A method according to claim 5, wherein said mechanical locking means includes undercuts located on an inner surface of said one of said plurality of components  
10 such that said integral neck may be formed about said undercuts which prevent removal of said one of said plurality of components from said integral neck.

7. A method according to any one of claims 3 to 6,  
15 wherein said one of said plurality of components includes an external threaded surface cooperable with another of said plurality of components, for attachment thereto.

8. A method according to any one of claims 4 to 7  
20 wherein said one of said plurality of components is formed of a material which readily heat bonds to said heat softened thermoplastic sheet of said neck as it is being formed within said cavity.

9. A method according to claim 1, wherein said cavity  
25 is a mould cavity which may be shaped in any suitable manner to form an integral neck.

10. A method according to claim 9, wherein said integral  
30 neck is formed as either, a spray nozzle, a tube, a flared section to act as a funnel or pedestal, or an attachment member for attachment of another member thereto.

11. A method according to claim 9, wherein said mould  
35 cavity includes a screw thread such that said formed integral neck includes a screw thread complimentary to said mould cavity screw thread.

12. A method according to claim 11, wherein said mould  
40 cavity is removed from about said formed integral neck by

- 13 -

rotating either of said container or said mould cavity.

13. A method according to claim 12, wherein said cavity is moved in concert with said stretching tool, such that  
5 said portion of said base is pushed into said cavity during dilation of said thermoplastic sheet.

14. A method according to any one of claims 1 to 13,  
10 wherein said stretching tool includes a push rod to push a portion of said base into said cavity.

15. A method according to claim 14, wherein the wall thickness of said integral neck is dependent on the clearance between the outer surface of said push rod and  
15 the inner surface of said cavity and the starting thickness of said thermoplastic sheet.

16. A method according to any preceeding claim, wherein said integral neck includes a nipple closure membrane  
20 which extends across the opening of the integral neck to close that opening.

17. Apparatus for stretch-forming a heat softened sheet of thermoplastic material, said apparatus including means  
25 to hold said sheet against substantial non-stretching movement, a stretching tool, and means to cause a primary movement of said stretching tool relative to the sheet so as to cause said tool to press against said sheet and to stretch said sheet, said stretching tool including at  
30 least one tip for pressing against said sheet to cause it to stretch, means to dilate said sheet simultaneously with the continued primary movement of said stretching tool in a direction transverse to the direction of the primary movement of said tool, cavity means of reduced cross  
35 section with respect to said container formed by said dilation, and means to conform a portion of said sheet to the surface profile of said cavity.

18. Apparatus according to claim 17, wherein said means  
40 to dilate said sheet includes a plurality of blades

- 14 -

movable in a direction substantially transverse to the direction of the primary movement of said stretching tool.

19. Apparatus according to claim 17 or 18, wherein said  
5 blades pivot about a pivot ring from an initial position located adjacent said stretching tool to a final position pivoted outwardly from said stretching tool.

20. Apparatus according to any one of claims 17 to 19,  
10 wherein said conforming means includes a plunger adapted to push a portion of said sheet into said cavity.

21. Apparatus according to claim 20, wherein said blades  
15 include blade tips and wherein said blade tips extend to a lesser extent in the direction of primary movement of said stretching tool than said plunger.

22. Apparatus according to any one of claims 17 to 21,  
20 wherein said conforming means includes an arrangement for blow moulding a portion of said sheet to conform to said surface profile of said cavity.

23. Apparatus according to any one of claims 17 to 22  
25 including a first housing in the form of a barrel cam which extends about said stretching tool before the commencement of said primary movement, and a second housing in the form of a mould cavity into which said stretching tool extends upon said primary movement.

24. Apparatus according to claim 20, wherein either of  
30 said first and second housings includes a port for the entry of pressurised fluid to effect said blow moulding.

25. Apparatus according to any one of claims 17 to 24,  
35 wherein said apparatus includes means for moving said cavity in concert with said stretching tool.

26. Apparatus according to claim 25, wherein said means  
40 for moving said cavity includes a shaft connected to said cavity, which shaft is movable in the direction of

- 15 -

movement of said stretching tool.

27. A collapsible package manufactured in accordance with the method of any one of claims 1 to 16.

5

28. A collapsible package manufactured in accordance with the apparatus of any one of claims 17 to 26.

10

15

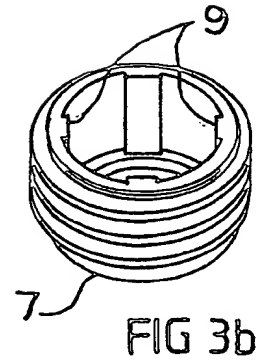
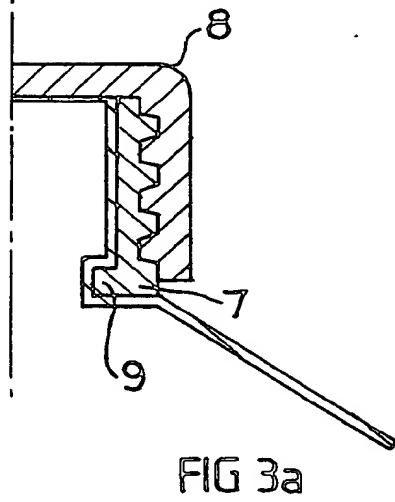
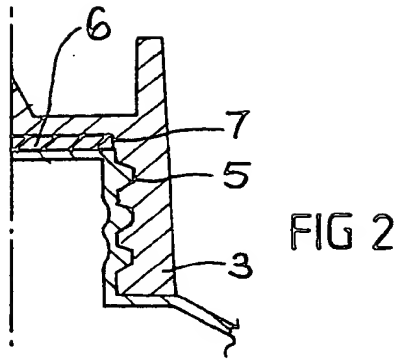
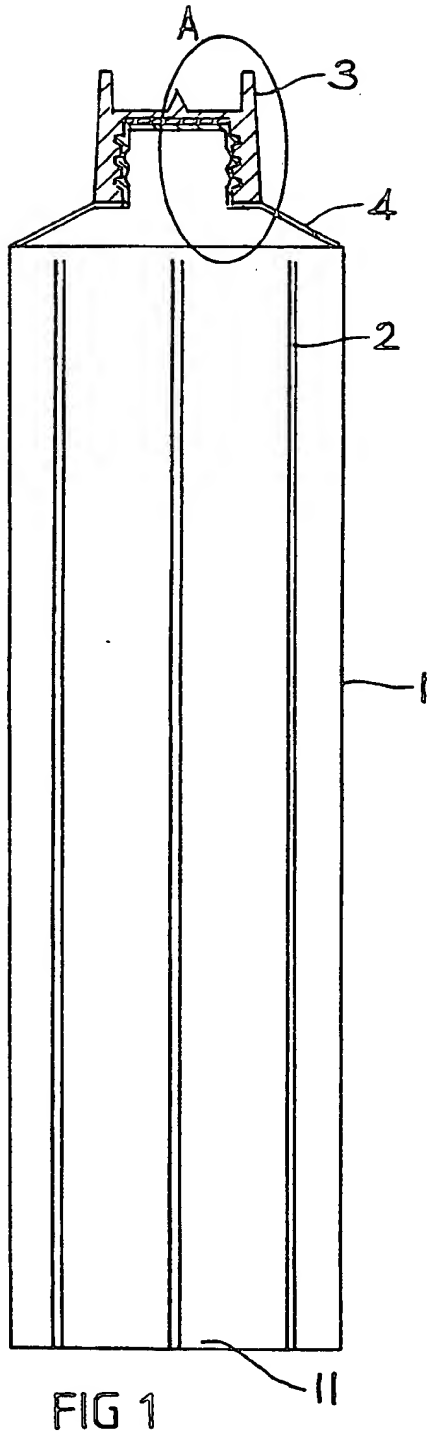
20

25

30

35

40



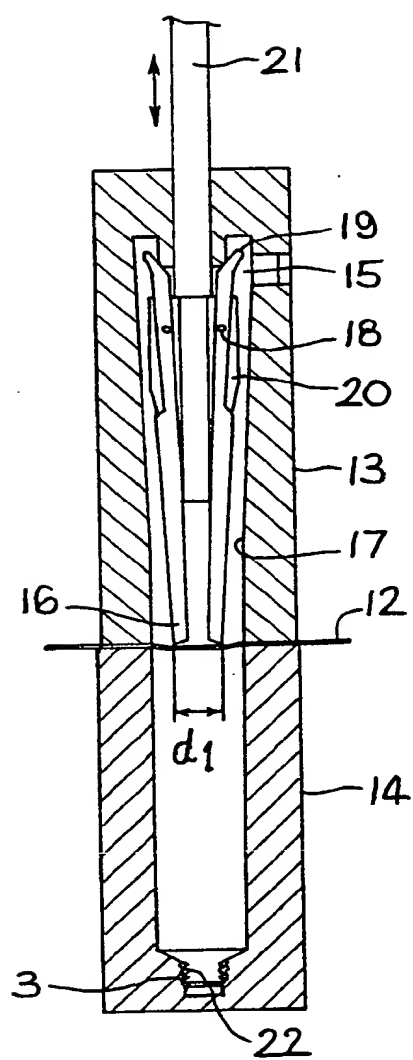


FIG 4a

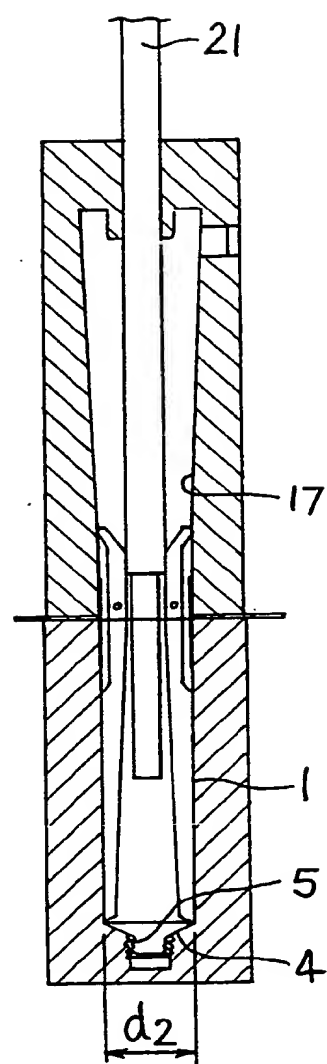
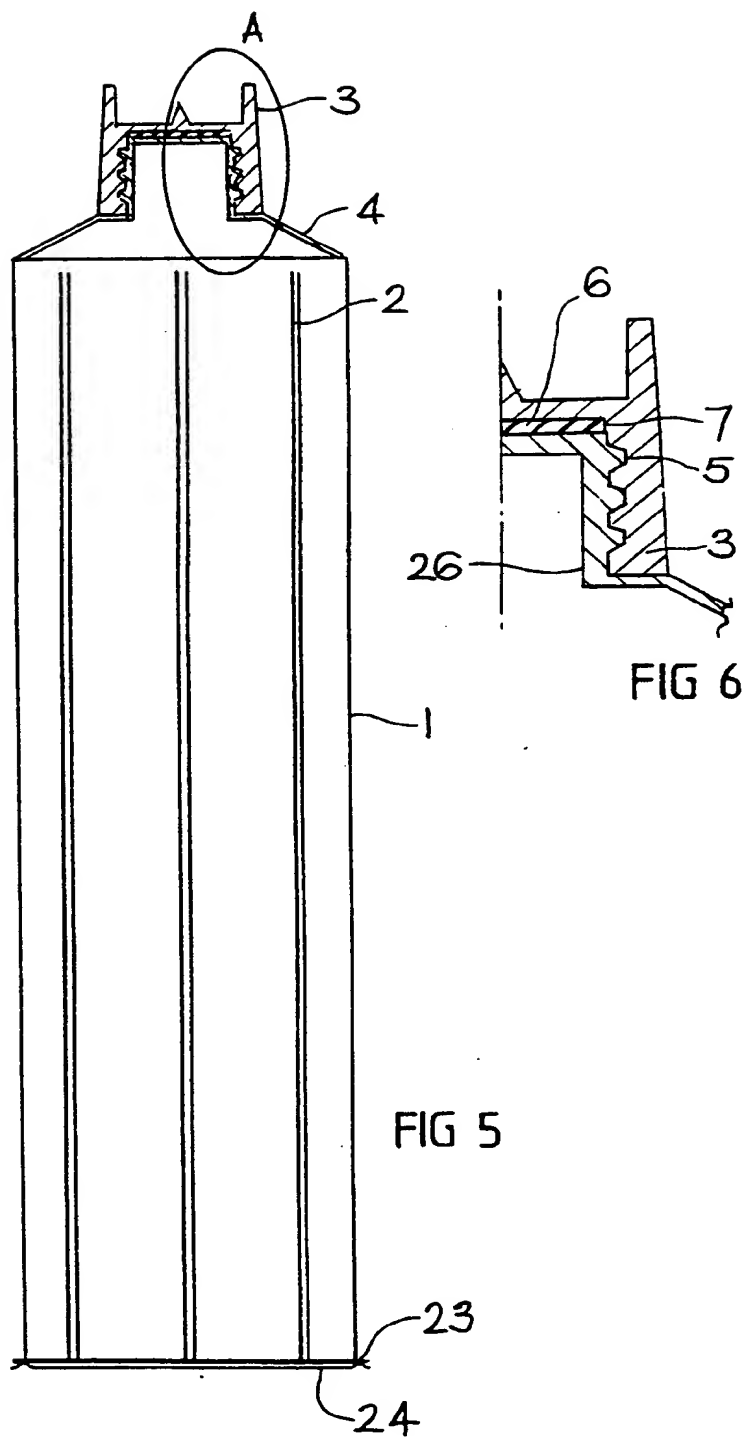


FIG 4b

3/9



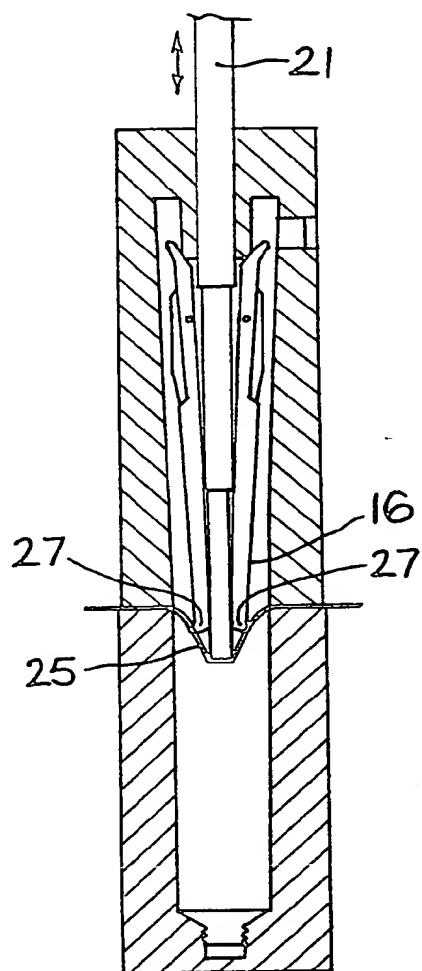


FIG 7a

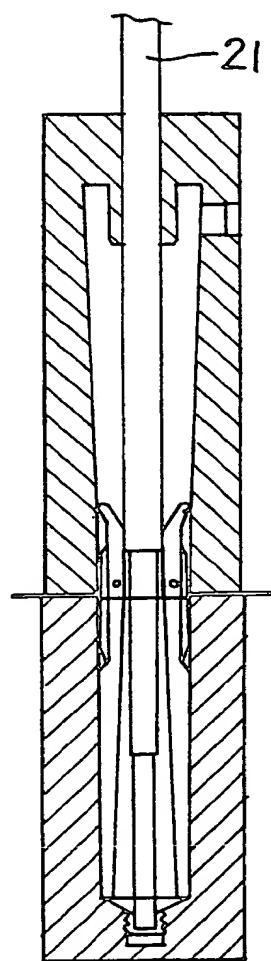
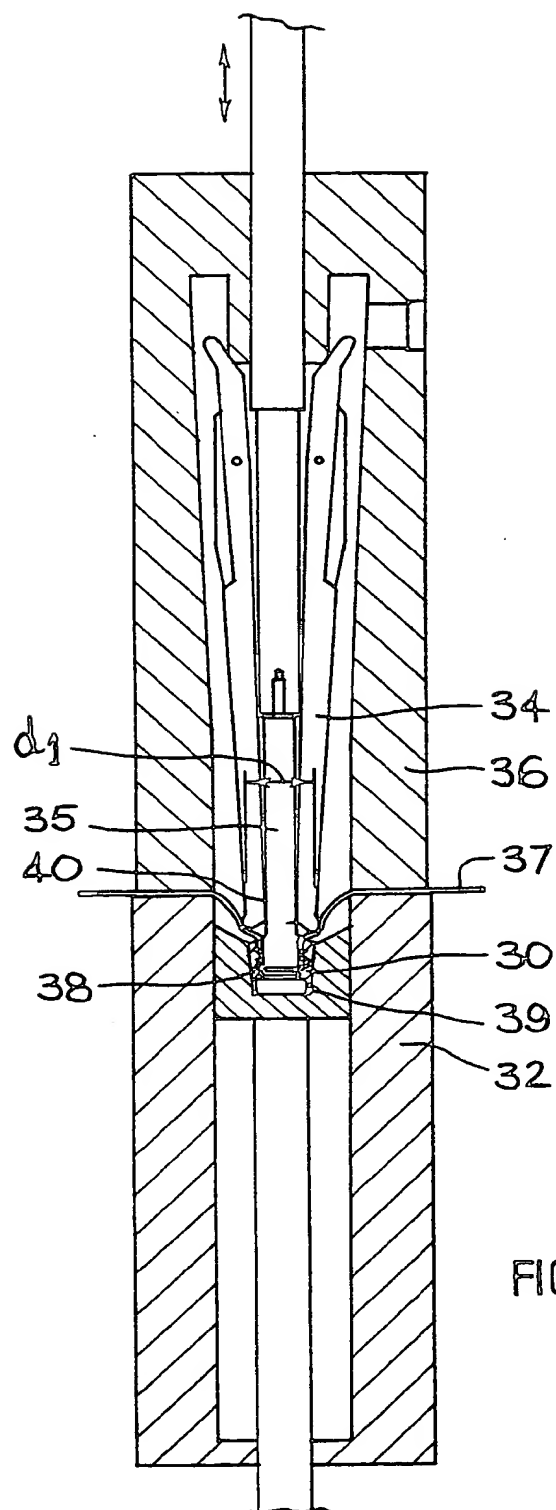
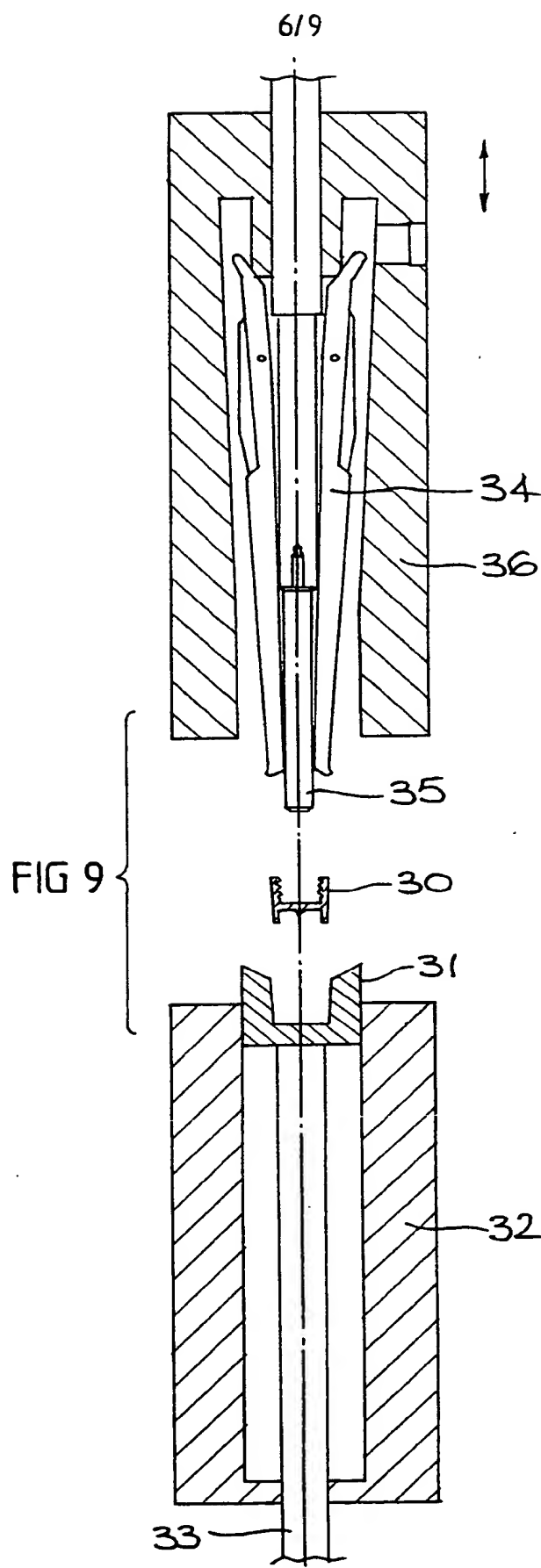


FIG 7b

5/9





7/9

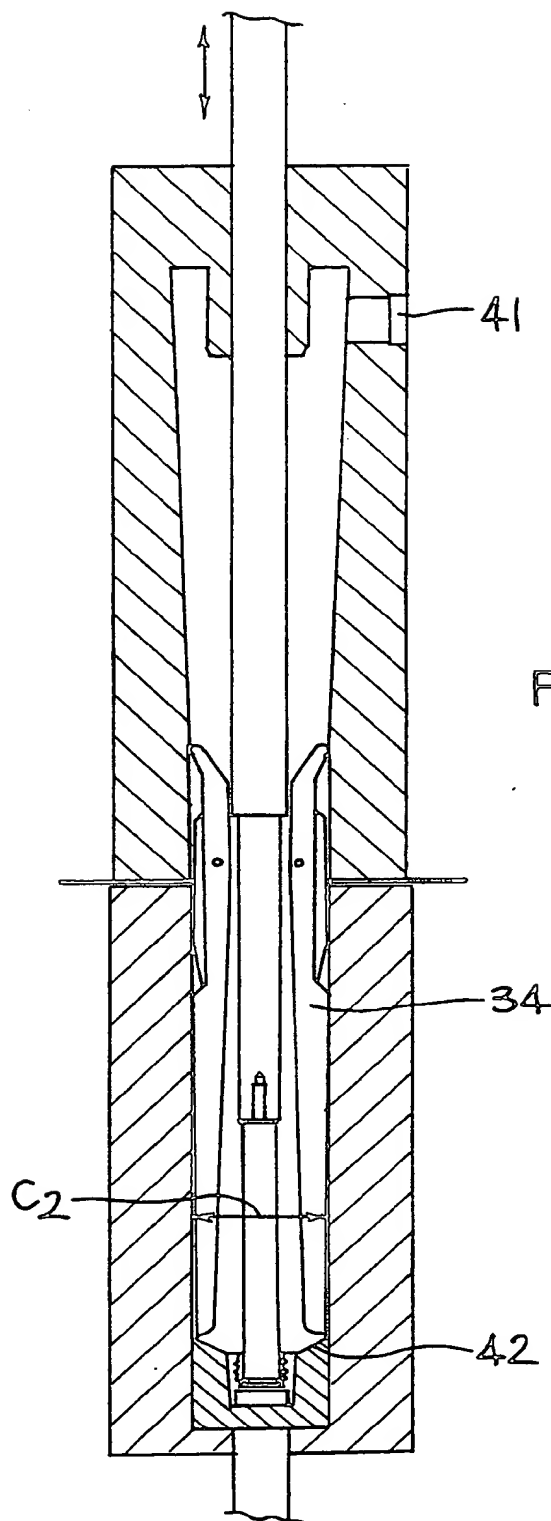
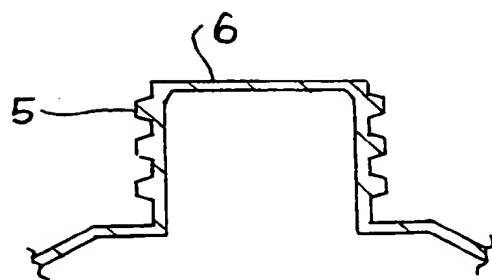
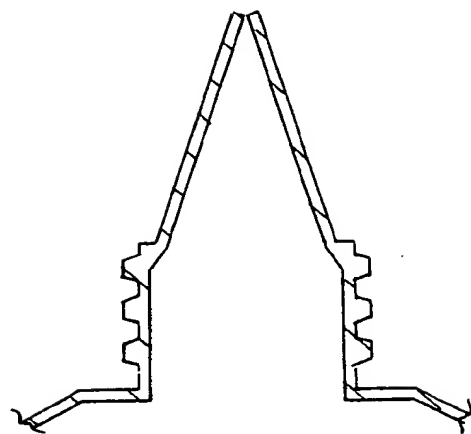
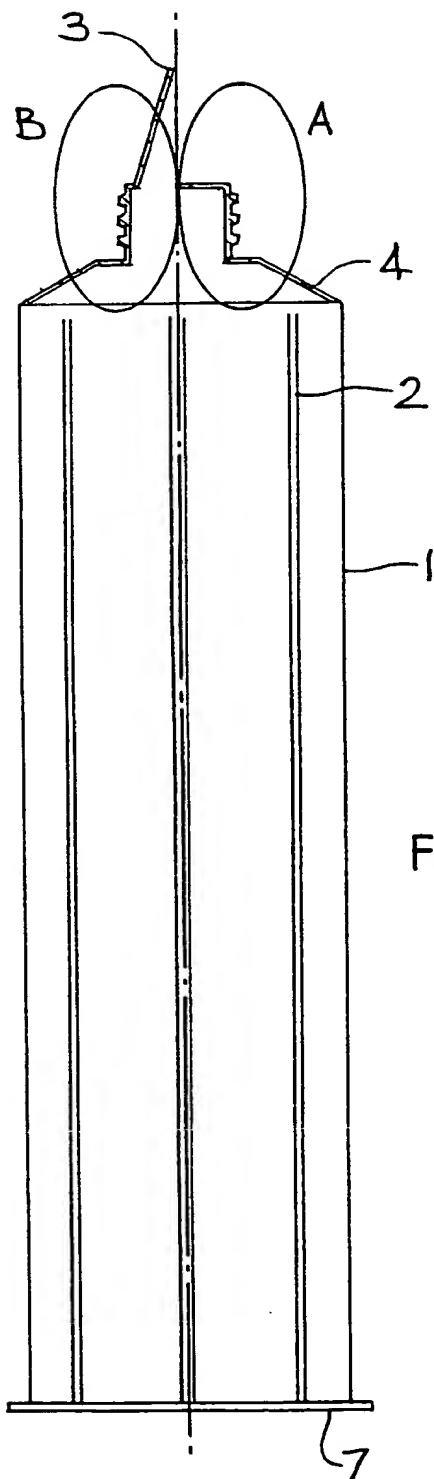


FIG 10



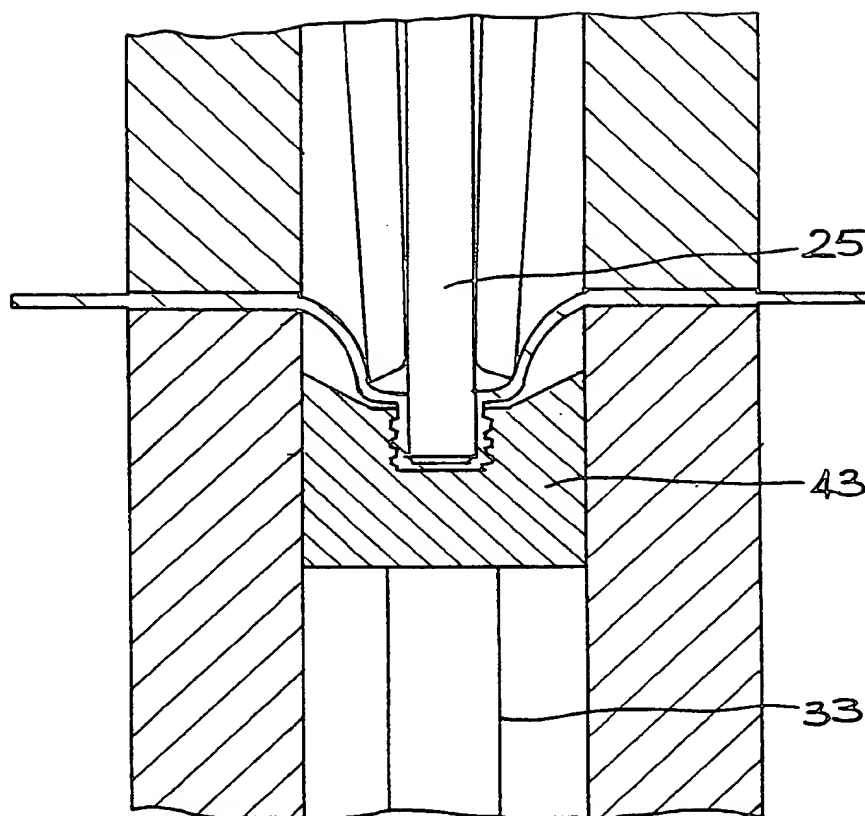


FIG 14

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 94/00371

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int. Cl. <sup>6</sup> B29C 51/08 // B29L 23:20  According to International Patent Classification (IPC) or to both national classification and IPC					
<b>B. FIELDS SEARCHED</b>  Minimum documentation searched (classification system followed by classification symbols) IPC B29C 51/08, 17/03, B29L 23:20, B65D 35/08  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU : IPC as above  Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)					
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>					
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.			
X	AU,A, 81441/82 (A.A.R.C. (MANAGEMENT) PTY LIMITED) 2 September 1982 (02.09.82) page 18 lines 20-37 and fig 30	1-28			
A	AU,B, 47160/79 (A.A.R.C. (MANAGEMENT) PTY LIMITED) 1 May 1980 (01.05.80) whole document	1-28			
A	Patents Abstracts of Japan, M-1075, page 40, JP,A, 2-276620 (HOKKAI CAN CO LTD) 13 November 1990 (13.11.90) abstract	1-28			
<div style="display: flex; justify-content: space-between;"> <span><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.</span> <span><input checked="" type="checkbox"/> See patent family annex.</span> </div>					
<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top;">           * Special categories of cited documents :             "A" document defining the general state of the art which is not considered to be of particular relevance            "E" earlier document but published on or after the international filing date            "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)            "O" document referring to an oral disclosure, use, exhibition or other means            "P" document published prior to the international filing date but later than the priority date claimed         </td> <td style="width: 33%; vertical-align: top;">           "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention            "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone            "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art            "&amp;" document member of the same patent family         </td> <td style="width: 33%;"></td> </tr> </table>			* Special categories of cited documents :  "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
* Special categories of cited documents :  "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family				
Date of the actual completion of the international search 11 October 1994 (11.10.94)	Date of mailing of the international search report 14 Oct 1994 (14.10.94)				
Name and mailing address of the ISA/AU  AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA  Facsimile No. 06 2853929	Authorized officer  <div style="text-align: center;">               VENKAT IYER              Telephone No. (06) 2832144           </div>				

## INTERNATIONAL SEARCH REPORT

Internati nal applicati n No. :  
PCT/AU 94/00371

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation f d cument, with indication, where appropriate of the relevant passages	Relevant to Claim N .
A	US,A, 3901640 (TIGNER et al) 26 August 1975 (26.08.75) whole document	1-28
A	EP,A, 6682 (ICI AUSTRALIA LIMITED) 9 January 1980 (09.01.80) whole document	1-28

**INTERNATIONAL SEARCH REPORT**  
Information on patent family member.

International application No.  
PCT/AU 94/00371

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
EP	6682	AT	10457	AU	47160/79	DK	2053/79
		HK	493/88	JP	55007486	NO	791654
		NZ	190442	SG	1019/87	US	4288401
		CA	1135020	AU	81441/82	US	4480979
		BE	892233	GR	76068	IL	65231
		PT	74483	WO	8202850	IT	8219802
		ZA	8201179				
AU	47160/79	AT	10457	CA	1135020	DK	2053/79
		EP	6682	HK	493/88	NO	791654
		NZ	190442	SG	1019/87	US	4288401
		US	4480979	JP	55007486	BE	892233
		GR	76068	IL	65231	PT	74483
		WO	8202850	ZA	8201179		
AU	81441/82	BE	892233	EP	72832	GR	76068
		IL	65231	IT	8219802	PT	74483
		WO	8202850	US	4480979	ZA	8201179
		CA	1135020	DK	2053/79	EP	6682
		HK	493/88	NO	791654	NZ	190442
		SG	1019/87	JP	55007486		
US	3901640	BE	822842	CA	1019918	DE	2455256
		FR	2278469	GB	1489418	IT	1023444
		JP	50087162	NL	7415408	ZA	7600744
END OF ANNEX							

